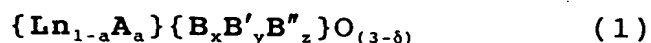


WHAT IS CLAIMED IS:

1. A ceramic composition as a mixed conducting oxide in perovskite structure, said composition being expressed by the following general formula (1):



where Ln represents one or a combination of elements selected from the group of Y and lanthanoids;

A represents one or a combination of elements selected from the group of Ba, Sr, and Ca;

B represents one or a combination of elements selected from the group of Co, Fe, Cr, and ¹³Ga, B always containing Fe or Co, the sum of the molar numbers of Cr and Ga being within the range of 0% to 20% of the total molar number x of B;

B' represents one or a combination of elements selected from the group of Nb, Ta, Ti, and Zr, B' always containing Nb or Ta, the sum of the molar numbers of Ti and Zr being within the range of 0% to 20% of the total molar number y of B';

B'' represents one or a combination of elements selected from the group of Cu, Ni, Zn, Li, and Mg;

$$0.8 \leq a \leq 1; 0 < x; 0 < y \leq 0.5; 0 \leq z \leq 0.2;$$

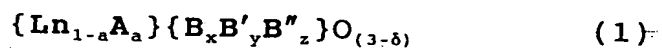
$$0.98 \leq x + y + z \leq 1.02; \text{ and}$$

δ represents a value which is so determined as to meet charge neutralization conditions.

2. A composition according to claim 1, wherein B always contains Fe, the molar number of Co is within the range of 0% to 10% of the molar number of Fe, the sum of the molar numbers of Cr and Ga being within the range of 0% to 20% of the total molar number x of B; and B'' represents one or a combination of

elements selected from the group of Zn, Li, and Mg.

3. A composite material comprising a porous body portion comprising a mixed conducting oxide, and a film portion including a gastight dense continuous layer of a mixed conducting oxide formed on said porous body portion, wherein at least one of said porous body portion and said dense continuous layer includes a ceramic composition in perovskite structure expressed by the following general formula (1):



where Ln represents one or a combination of elements selected from the group of Y and lanthanoids;

A represents one or a combination of elements selected from the group of Ba, Sr, and Ca;

B represents one or a combination of elements selected from the group of Co, Fe, Cr, and Ga, B always containing Fe or Co, the sum of the molar numbers of Cr and Ga being within the range of 0% to 20% of the total molar number x of B;

B' represents one or a combination of elements selected from the group of Nb, Ta, Ti, and Zr, B' always containing Nb or Ta, the sum of the molar numbers of Ti and Zr being within the range of 0% to 20% of the total molar number y of B';

B'' represents one or a combination of elements selected from the group of Cu, Ni, Zn, Li, and Mg;

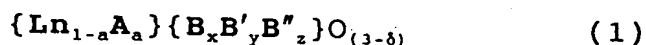
$$0.8 \leq a \leq 1; 0 < x; 0 < y \leq 0.5; 0 \leq z \leq 0.2;$$

$$0.98 \leq x + y + z \leq 1.02; \text{ and}$$

δ represents a value which is so determined as to meet charge neutralization conditions.

4. A composite material comprising a porous body portion

comprising a mixed conducting oxide, and a film portion including a gastight dense continuous layer of a mixed conducting oxide formed on said porous body portion, wherein at least one of said porous body portion and said dense continuous layer includes a ceramic composition in perovskite structure expressed by the following general formula (1):



where Ln represents one or a combination of elements selected from the group of Y and lanthanoids;

A represents one or a combination of elements selected from the group of Ba, Sr, and Ca;

B represents one or a combination of elements selected from the group of Co, Fe, Cr, and Ga, B always containing Fe, the molar number of Co being within the range of 0% to 10% of the molar number of Fe, the sum of the molar numbers of Cr and Ga being within the range of 0% to 20% of the total molar number x of B;

B' represents one or a combination of elements selected from the group of Nb, Ta, Ti, and Zr, B' always containing Nb or Ta, the sum of the molar numbers of Ti and Zr being within the range of 0% to 20% of the total molar number y of B';

B'' represents one or a combination of elements selected from the group of Zn, Li, and Mg;

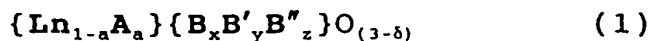
$$0.8 \leq a \leq 1; 0 < x; 0 < y \leq 0.5; 0 \leq z \leq 0.2;$$

$$0.98 \leq x + y + z \leq 1.02; \text{ and}$$

δ represents a value which is so determined as to meet charge neutralization conditions.

5. An oxygen separator including a ceramic composition as

a mixed conducting oxide in perovskite structure, said composition being expressed by the following general formula (1):



where Ln represents one or a combination of elements selected from the group of Y and lanthanoids;

A represents one or a combination of elements selected from the group of Ba, Sr, and Ca;

B represents one or a combination of elements selected from the group of Co, Fe, Cr, and Ga, B always containing Fe or Co, the sum of the molar numbers of Cr and Ga being within the range of 0% to 20% of the total molar number x of B;

B' represents one or a combination of elements selected from the group of Nb, Ta, Ti, and Zr, B' always containing Nb or Ta, the sum of the molar numbers of Ti and Zr being within the range of 0% to 20% of the total molar number y of B';

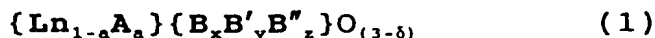
B'' represents one or a combination of elements selected from the group of Cu, Ni, Zn, Li, and Mg;

$$0.8 \leq a \leq 1; 0 < x; 0 < y \leq 0.5; 0 \leq z \leq 0.2;$$

$$0.98 \leq x + y + z \leq 1.02; \text{ and}$$

δ represents a value which is so determined as to meet charge neutralization conditions.

6. An oxygen separator including a ceramic composition as a mixed conducting oxide in perovskite structure, said composition being expressed by the following general formula (1):



where Ln represents one or a combination of elements

selected from the group of Y and lanthanoids;

A represents one or a combination of elements selected from the group of Ba, Sr, and Ca;

B represents one or a combination of elements selected from the group of Co, Fe, Cr, and Ga, B always containing Fe, the molar number of Co being within the range of 0% to 10% of the molar number of Fe, the sum of the molar numbers of Cr and Ga being within the range of 0% to 20% of the total molar number x of B;

B' represents one or a combination of elements selected from the group of Nb, Ta, Ti, and Zr, B' always containing Nb or Ta, the sum of the molar numbers of Ti and Zr being within the range of 0% to 20% of the total molar number y of B';

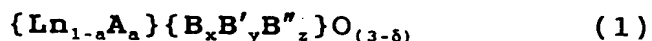
B'' represents one or a combination of elements selected from the group of Zn, Li, and Mg;

$$0.8 \leq a \leq 1; 0 < x; 0 < y \leq 0.5; 0 \leq z \leq 0.2;$$

$$0.98 \leq x + y + z \leq 1.02; \text{ and}$$

δ represents a value which is so determined as to meet charge neutralization conditions.

7. A chemical reactor including a ceramic composition as a mixed conducting oxide in perovskite structure, said composition being expressed by the following general formula (1):



where Ln represents one or a combination of elements selected from the group of Y and lanthanoids;

A represents one or a combination of elements selected from the group of Ba, Sr, and Ca;

B represents one or a combination of elements selected from the group of Co, Fe, Cr, and Ga, B always containing Fe or Co, the sum of the molar numbers of Cr and Ga being within the range of 0% to 20% of the total molar number x of B;

B' represents one or a combination of elements selected from the group of Nb, Ta, Ti, and Zr, B' always containing Nb or Ta, the sum of the molar numbers of Ti and Zr being within the range of 0% to 20% of the total molar number y of B';

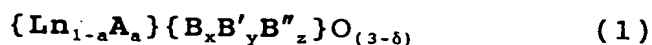
B'' represents one or a combination of elements selected from the group of Cu, Ni, Zn, Li, and Mg;

$$0.8 \leq a \leq 1; 0 < x; 0 < y \leq 0.5; 0 \leq z \leq 0.2;$$

$$0.98 \leq x + y + z \leq 1.02; \text{ and}$$

δ represents a value which is so determined as to meet charge neutralization conditions.

8. A chemical reactor including a ceramic composition as a mixed conducting oxide in perovskite structure, said composition being expressed by the following general formula (1):



where Ln represents one or a combination of elements selected from the group of Y and lanthanoids;

A represents one or a combination of elements selected from the group of Ba, Sr, and Ca;

B represents one or a combination of elements selected from the group of Co, Fe, Cr, and Ga, B always containing Fe, the molar number of Co being within the range of 0% to 10% of the molar number of Fe, the sum of the molar numbers of Cr and Ga being within the range of 0% to 20% of the total molar number

x of B;

B' represents one or a combination of elements selected from the group of Nb, Ta, Ti, and Zr, B' always containing Nb or Ta, the sum of the molar numbers of Ti and Zr being within the range of 0% to 20% of the total molar number y of B';

B'' represents one or a combination of elements selected from the group of Zn, Li, and Mg;

$$0.8 \leq a \leq 1; 0 < x; 0 < y \leq 0.5; 0 \leq z \leq 0.2;$$

$$0.98 \leq x + y + z \leq 1.02; \text{ and}$$

δ represents a value which is so determined as to meet charge neutralization conditions.

9. A composite material comprising a porous body portion comprising a mixed conducting oxide, and a film portion including a gastight dense continuous layer of a mixed conducting oxide formed on said porous body portion, wherein the maximum heat treatment temperature for said porous body portion is higher than that for said dense continuous layer.

10. A method of producing a composite material, wherein a porous body portion comprising a mixed conducting oxide is sintered at a temperature higher than the sintering temperature for a dense continuous layer of a mixed conducting oxide to be formed on said porous body portion, and then a film portion including said dense continuous layer is formed on said porous body portion.

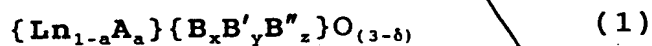
11. A composite material comprising a porous body portion comprising a mixed conducting oxide, and a film portion including a dense continuous layer of a mixed conducting oxide formed on said porous body portion, wherein the densifying

temperature for the oxide material of said porous body portion is higher than that for the material of said film portion.

12. A material according to claim 9 or 11, wherein the porosity of said porous body portion is within the range of 20% to 80%, and the thickness of said dense continuous layer is within the range of 10 μm to 1 mm.

13. A composite material comprising a porous body portion comprising a mixed conducting oxide, and a film portion including a dense continuous layer of a mixed conducting oxide formed on said porous body portion, wherein the densifying temperature for the oxide material of said porous body portion is higher than that for the material of said film portion, or the maximum heat treatment temperature for said porous body portion is higher than that for said dense continuous layer, and

said porous body portion comprises a ceramic composition as a mixed conducting oxide in perovskite structure, said composition being expressed by the following general formula (1):



where Ln represents one or a combination of elements selected from the group of Y and lanthanoids;

A represents one or a combination of elements selected from the group of Ba, Sr, and Ca;

B represents one or a combination of elements selected from the group of Co, Fe, Cr, and Ga, B always containing Fe or Co, the sum of the molar numbers of Cr and Ga being within the range of 0% to 20% of the total molar number x of B;

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B' represents one or a combination of elements selected from the group of Nb, Ta, Ti, and Zr, B' always containing Nb or Ta, the sum of the molar numbers of Ti and Zr being within the range of 0% to 20% of the total molar number y of B';

B'' represents one or a combination of elements selected from the group of Cu, Ni, Zn, Li, and Mg;

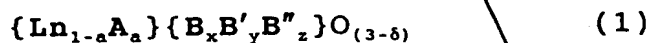
$$0.8 \leq a \leq 1; 0 < x; 0 < y \leq 0.5; 0 \leq z \leq 0.2;$$

$$0.98 \leq x + y + z \leq 1.02; \text{ and}$$

δ represents a value which is so determined as to meet charge neutralization conditions.

14. A composite material comprising a porous body portion comprising a mixed conducting oxide, and a film portion including a dense continuous layer of a mixed conducting oxide formed on said porous body portion, wherein the densifying temperature for the oxide material of said porous body portion is higher than that for the material of said film portion, or the maximum heat treatment temperature for said oxide material of said porous body portion is higher than that for said dense continuous layer, and

said porous body portion comprises a ceramic composition as a mixed conducting oxide in perovskite structure, said composition being expressed by the following general formula (1):



where Ln represents one or a combination of elements selected from the group of Y and lanthanoids;

A represents one or a combination of elements selected from the group of Ba, Sr, and Ca;

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B represents one or a combination of elements selected from the group of Co, Fe, Cr, and Ga, B always containing Fe, the molar number of Co being within the range of 0% to 10% of the molar number of Fe, the sum of the molar numbers of Cr and Ga being within the range of 0% to 20% of the total molar number x of B;

B' represents one or a combination of elements selected from the group of Nb, Ta, Ti, and Zr, B' always containing Nb or Ta, the sum of the molar numbers of Ti and Zr being within the range of 0% to 20% of the total molar number y of B';

B'' represents one or a combination of elements selected from the group of Zn, Li, and Mg;

$$0.8 \leq a \leq 1; 0 < x; 0 < y \leq 0.5; 0 \leq z \leq 0.2;$$

$$0.98 \leq x + y + z \leq 1.02; \text{ and}$$

δ represents a value which is so determined as to meet charge neutralization conditions.

15. A porous body comprising a mixed conducting oxide expressed by the following general formula (2):



where $0.98 \leq x \leq 1.02$; A represents one or a combination of elements selected from the group of Ba, Sr, and Ca; and δ represents a value which is so determined as to meet charge neutralization conditions.

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16. A composite material comprising a porous body portion comprising a mixed conducting oxide, and a film portion including a gastight dense continuous layer of a mixed conducting oxide formed on said porous body portion, wherein said porous body portion comprises a porous body comprising

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a mixed conducting oxide expressed by the following general formula (2):



where $0.98 \leq x \leq 1.02$; A represents one or a combination of elements selected from the group of Ba, Sr, and Ca; and δ represents a value which is so determined as to meet charge neutralization conditions.

15 1/. A material according to claim 14, wherein said material is made in the manner that said porous body portion comprising said mixed conducting oxide is sintered at a temperature higher than the sintering temperature for said dense continuous layer of said mixed conducting oxide to be formed on said porous body portion, and then said film portion including said dense continuous layer is formed on said porous body portion.

18. A material according to claim 16, wherein said dense continuous layer is made of a mixed conducting oxide material having its composition different from said porous body portion.

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19. A method of producing a composite material which comprises a porous body portion including a mixed conducting oxide, and a film portion including a gastight dense continuous layer of a mixed conducting oxide formed on said porous body portion, said porous body portion comprising a porous body comprising a mixed conducting oxide expressed by the following general formula (2):



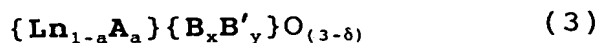
where $0.98 \leq x \leq 1.02$; A represents one or a combination of elements selected from the group of Ba, Sr, and Ca; and δ

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represents a value which is so determined as to meet charge neutralization conditions,

wherein said porous body portion is subjected to a heat treatment the maximum temperature for which is within the range of 1200°C to 1400°C, and said dense continuous layer is subjected to a heat treatment the maximum temperature for which is lower than that for said porous body portion by 20°C or more.

1720. A material according to claim ¹²17, wherein said dense continuous layer is made of a ceramic of a mixed conducting oxide having its composition expressed by the following general formula (3):



where Ln represents one or a combination of elements selected from the group of Y and lanthanoids;

A represents one or a combination of elements selected from the group of Ba, Sr, and Ca;

B represents one or a combination of elements selected from the group of Fe and Co;

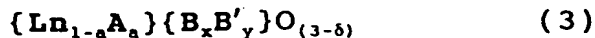
B' represents one or a combination of elements selected from the group of Cu, Ni, Zn, Li, and Mg;

$$0.8 \leq a \leq 1; 0 < x; 0 \leq y \leq 0.2;$$

$$0.98 \leq x + y \leq 1.02; \text{ and}$$

δ represents a value which is so determined as to meet charge neutralization conditions.

21. A material according to claim 16, wherein said dense continuous layer is made of a ceramic of a mixed conducting oxide having its composition expressed by the following general formula (3):



where Ln represents one or a combination of elements selected from the group of Y and lanthanoids;

A represents one or a combination of elements selected from the group of Ba, Sr, and Ca;

B represents one or a combination of elements selected from the group of Fe and Co;

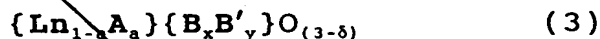
B' represents one or a combination of elements selected from the group of Cu, Ni, Zn, Li, and Mg;

$$0.8 \leq a \leq 1; 0 < x; 0 \leq y \leq 0.2;$$

$$0.98 \leq x + y \leq 1.02; \text{ and}$$

δ represents a value which is so determined as to meet charge neutralization conditions.

22. A material according to claim 14, wherein said dense continuous layer is made of a ceramic of a mixed conducting oxide having its composition expressed by the following general formula (3):



where Ln represents one or a combination of elements selected from the group of Y and lanthanoids;

A represents one or a combination of elements selected from the group of Ba, Sr, and Ca;

B represents one or a combination of elements selected from the group of Fe and Co;

B' represents one or a combination of elements selected from the group of Cu, Ni, Zn, Li, and Mg;

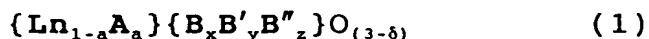
$$0.8 \leq a \leq 1; 0 < x; 0 \leq y \leq 0.2;$$

$$0.98 \leq x + y \leq 1.02; \text{ and}$$

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~~δ represents a value which is so determined as to meet charge neutralization conditions.~~

19/23. A material according to claim 11, wherein said dense continuous layer is made of a ceramic composition as a mixed conducting oxide in perovskite structure, said composition being expressed by the following general formula (1):



where Ln represents one or a combination of elements selected from the group of Y and lanthanoids;

A represents one or a combination of elements selected from the group of Ba, Sr, and Ca;

B represents one or a combination of elements selected from the group of Co, Fe, Cr, and Ga, B always containing Fe or Co, the sum of the molar numbers of Cr and Ga being within the range of 0% to 20% of the total molar number x of B;

B' represents one or a combination of elements selected from the group of Nb, Ta, Ti, and Zr, B' always containing Nb or Ta, the sum of the molar numbers of Ti and Zr being within the range of 0% to 20% of the total molar number y of B';

B'' represents one or a combination of elements selected from the group of Cu, Ni, Zn, Li, and Mg;

$$0.8 \leq a \leq 1; 0 < x; 0 < y \leq 0.5; 0 \leq z \leq 0.2;$$

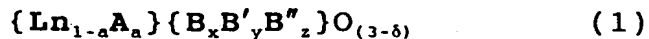
$$0.98 \leq x + y + z \leq 1.02; \text{ and}$$

δ represents a value which is so determined as to meet charge neutralization conditions.

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~~24. A material according to claim 13, wherein said dense continuous layer is made of a ceramic composition as a mixed conducting oxide in perovskite structure, said composition~~

being expressed by the following general formula (1):



where Ln represents one or a combination of elements selected from the group of Y and lanthanoids;

A represents one or a combination of elements selected from the group of Ba, Sr, and Ca;

B represents one or a combination of elements selected from the group of Co, Fe, Cr, and Ga, B always containing Fe or Co, the sum of the molar numbers of Cr and Ga being within the range of 0% to 20% of the total molar number x of B;

B' represents one or a combination of elements selected from the group of Nb, Ta, Ti, and Zr, B' always containing Nb or Ta, the sum of the molar numbers of Ti and Zr being within the range of 0% to 20% of the total molar number y of B';

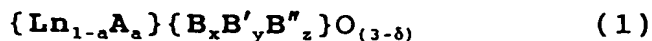
B'' represents one or a combination of elements selected from the group of Cu, Ni, Zn, Li, and Mg;

$$0.8 \leq a \leq 1; 0 < x; 0 < y \leq 0.5; 0 \leq z \leq 0.2;$$

$$0.98 \leq x + y + z \leq 1.02; \text{ and}$$

δ represents a value which is so determined as to meet charge neutralization conditions.

21/25. A material according to claim 11, wherein said dense continuous layer is made of a ceramic composition as a mixed conducting oxide in perovskite structure, said composition being expressed by the following general formula (1):



where Ln represents one or a combination of elements selected from the group of Y and lanthanoids;

A represents one or a combination of elements selected

from the group of Ba, Sr, and Ca;

B represents one or a combination of elements selected from the group of Co, Fe, Cr, and Ga, B always containing Fe, the molar number of Co being within the range of 0% to 10% of the molar number of Fe, the sum of the molar numbers of Cr and Ga being within the range of 0% to 20% of the total molar number x of B;

B' represents one or a combination of elements selected from the group of Nb, Ta, Ti, and Zr, B' always containing Nb or Ta, the sum of the molar numbers of Ti and Zr being within the range of 0% to 20% of the total molar number y of B';

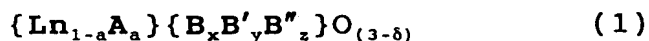
B'' represents one or a combination of elements selected from the group of Zn, Li, and Mg;

$$0.8 \leq a \leq 1; 0 < x; 0 < y \leq 0.5; 0 \leq z \leq 0.2;$$

$$0.98 \leq x + y + z \leq 1.02; \text{ and}$$

δ represents a value which is so determined as to meet charge neutralization conditions.

~~22~~ ²⁰ 26. A material according to claim ~~24~~ ²⁰, wherein said dense continuous layer is made of a ceramic composition as a mixed conducting oxide in perovskite structure, said composition being expressed by the following general formula (1):



where Ln represents one or a combination of elements selected from the group of Y and lanthanoids;

A represents one or a combination of elements selected from the group of Ba, Sr, and Ca;

B represents one or a combination of elements selected from the group of Co, Fe, Cr, and Ga, B always containing Fe

or Co, the sum of the molar numbers of Cr and Ga being within the range of 0% to 20% of the total molar number x of B;

B' represents one or a combination of elements selected from the group of Nb, Ta, Ti, and Zr, B' always containing Nb or Ta, the sum of the molar numbers of Ti and Zr being within the range of 0% to 20% of the total molar number y of B';

B'' represents one or a combination of elements selected from the group of Cu, Ni, Zn, Li, and Mg;

$$0.8 \leq a \leq 1; 0 < x; 0 < y \leq 0.5; 0 \leq z \leq 0.2;$$

$$0.98 \leq x + y + z \leq 1.02; \text{ and}$$

δ represents a value which is so determined as to meet charge neutralization conditions,

the sum of the molar numbers of Nb and Ta for the dense continuous layer is smaller than that for the porous body.

23 ~~21~~. A material according to claim ~~20~~ ²², wherein, in said formula (1) expressing said ceramic composition of said dense continuous layer, B always contains Fe, the molar number of Co is within the range of 0% to 10% of the molar number of Fe, and B'' represents one or a combination of elements selected from the group of Zn, Li, and Mg.

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~~28. A material according to claim 16, wherein said dense continuous layer is made of a ceramic composition as a mixed conducting oxide in perovskite structure, said composition being expressed by the following general formula (1):~~



where Ln represents one or a combination of elements selected from the group of Y and lanthanoids;

A represents one or a combination of elements selected

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from the group of Ba, Sr, and Ca;

B represents one or a combination of elements selected from the group of Co, Fe, Cr, and Ga, B always containing Fe or Co, the sum of the molar numbers of Cr and Ga being within the range of 0% to 20% of the total molar number x of B;

B' represents one or a combination of elements selected from the group of Nb, Ta, Ti, and Zr, B' always containing Nb or Ta, the sum of the molar numbers of Ti and Zr being within the range of 0% to 20% of the total molar number y of B';

B'' represents one or a combination of elements selected from the group of Cu, Ni, Zn, Li, and Mg;

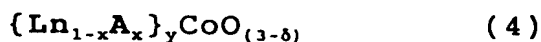
$$0.8 \leq a \leq 1; 0 < x; 0 < y \leq 0.5; 0 \leq z \leq 0.2;$$

$$0.98 \leq x + y + z \leq 1.02; \text{ and}$$

δ represents a value which is so determined as to meet charge neutralization conditions.

25 28. A material according to claim 24, wherein, in said formula (1) expressing said ceramic composition of said dense continuous layer, B always contains Fe, the molar number of Co is within the range of 0% to 10% of the molar number of Fe, and B'' represents one or a combination of elements selected from the group of Zn, Li, and Mg.

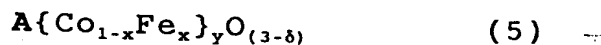
26 30. A material according to claim 12 or 14, wherein said dense continuous layer is made of a ceramic of a mixed conducting oxide having its composition expressed by the following general formula (4):



where Ln represents one or a combination of elements selected from the group of Y and lanthanoids; A represents one

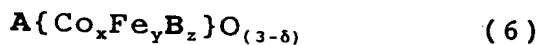
or a combination of elements selected from the group of Ba, Sr, and Ca; $0.8 \leq x \leq 1$; $0.98 \leq y \leq 1.02$; and δ represents a value which is so determined as to meet charge neutralization conditions.

27^{12/14} 31. A material according to claim 13 or 16, wherein said dense continuous layer is made of a ceramic of a mixed conducting oxide having its composition expressed by the following general formula (5):



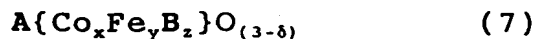
where A represents one or a combination of elements selected from the group of Ba, Sr, and Ca; $0 \leq x \leq 0.2$; $0.98 \leq y \leq 1.02$; and δ represents a value which is so determined as to meet charge neutralization conditions.

28^{12/14} 32. A material according to claim 13 or 16, wherein said dense continuous layer is made of a ceramic of a mixed conducting oxide having its composition expressed by the following general formula (6):



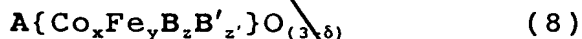
where A represents one or a combination of elements selected from the group of Ba, Sr, and Ca; B represents one or a combination of elements selected from the group of Cu, Ni, and Zn; $0 \leq x$; $0 \leq y$; $0 \leq z \leq 0.2$; $0.98 \leq x + y + z \leq 1.02$; and δ represents a value which is so determined as to meet charge neutralization conditions.

SWB
A4
~~33. A material according to claim 13 or 16, wherein said dense continuous layer is made of a ceramic of a mixed conducting oxide having its composition expressed by the following general formula (7):~~



where A represents one or a combination of elements selected from the group of Ba, Sr, and Ca; B represents one or a combination of elements selected from the group of Nb and Ta; $0 \leq x$; $0 \leq y$; $0 < z \leq 0.2$; $0.98 \leq x + y + z \leq 1.02$; and δ represents a value which is so determined as to meet charge neutralization conditions.

34. A material according to claim 13 or 16, wherein said dense continuous layer is made of a ceramic of a mixed conducting oxide having its composition expressed by the following general formula (8):



where A represents one or a combination of elements selected from the group of Ba, Sr, and Ca; B represents one or a combination of elements selected from the group of Nb and Ta; B' represents one or a combination of elements selected from the group of Cu, Ni, and Zn; $0 \leq x$; $0 \leq y$; $0 < z \leq 0.2$; $0 \leq z' \leq 0.2$; $0.98 \leq x + y + z + z' \leq 1.02$; and δ represents a value which is so determined as to meet charge neutralization conditions.

35. A composite material wherein an oxygen exchange layer is formed on a surface of one or either side of an oxide having oxide ion diffusivity, said layer being made of an oxide having its composition different from said oxide having oxide ion diffusivity.

32/36. A material according to claim 35, wherein said oxygen exchange layer comprises a dense film, a porous body, or island-shaped discontinuous films whose average thickness is

30 μm or less.

33 37. A material according to claim 31, wherein said oxide having oxide ion diffusivity is formed into a thin film whose thickness is 300 μm or less.

38. A material according to claim 35, wherein said oxygen exchange layer is made of an oxide expressed by $\text{La}_u\text{Sr}_{b-u}\text{Fe}_v\text{Co}_{c-v}\text{O}_{3-w}$ where $0.1 \leq u < 0.5$, $0.9 < b < 1.1$, $0 < v < 1.1$, and $0.9 < c < 1.1$.

39. A material according to any of claims 3, 4, 9, 11, 13, 14, and 20 to 29, wherein an oxygen exchange layer is formed on a surface of one or either side of said dense continuous layer, said oxygen exchange layer being made of an oxide having its composition different from the oxide forming said dense continuous layer.

40. A material according to any of claims 3, 4, 13, 14, and 20 to 29, wherein the porosity of said porous body portion is within the range of 20% to 80%, and the thickness of said dense continuous layer is within the range of 10 μm to 1 mm.

41. An oxygen separator including a composite material comprising a porous body portion comprising a mixed conducting oxide, and a film portion including a gastight dense continuous layer of a mixed conducting oxide formed on said porous body portion, wherein the maximum heat treatment temperature for said porous body portion is higher than that for said dense continuous layer.

42. A chemical reactor including a composite material comprising a porous body portion comprising a mixed conducting oxide, and a film portion including a gastight dense continuous

